

REMARKS/ARGUMENTS

Reconsideration of this application is requested. Claims 1, 2 and 4-12 will be pending in the application subsequent to entry of this Amendment.

In this response new claim 12 has been added based upon the description of the invention bridging pages 13 and 14 of the specification. Claims 1 and 8 have also been amended, the details of these amendments are contained in the following remarks.

The issues raised in the outstanding Official Action relate to patentability of the claims of the cited prior art. Applicants address the examiner's concerns with the following comments as well as amended claims.

With Respect to the Rejection of Claim 1

Claim 1 has been amended and directed to preferred aspects of the disclosure to further include the technical features of "at least a portion of the exhaust gas is already in an excited state when the exhaust gas is introduced into an excitation unit" and that "the exhaust gas is reacted with the reaction remover in the form of a viscous flow", and as a consequence claim 3 has been canceled.

In the present invention, since the exhaust gas discharged from a semiconductor manufacturing facility, which is already partially-excited, is introduced into an excitation unit, less energy is required to maintain the excited state. For example, in the case of treating the exhaust gas at the rate of 1 liter/minute, although the amount of energy required to generate plasma according to the present invention is about 1.5 kW, the amount of energy required when degrading exhaust gas at the rate of 1 liter/minute by again generating plasma under reduced pressure after tentatively discharging at atmospheric pressure using the invention disclosed in Japanese Patent Unexamined Application, First Publication No. H10-277354 was 5.5 kW. Namely, use of the present invention makes it possible to reduce the amount of energy required for plasma generation to about 30% of that of the prior art.

However, Breithbarth et al., do not teach the exhaust gas which is partially excited before introduction into an excitation unit.

Furthermore, in the present invention, since the exhaust gas is made to flow in the form

of a viscous flow during flow of the exhaust gas under reduced pressure, pressure loss can be reduced, and gas components in an excited state can be transported to the plasma device through comparatively narrow lines. Thus, the amount of space required for the lines from the first exhaust pump of the production equipment to the plasma device can be decreased. Allowing the exhaust gas to flow in the form of viscous flow under reduced pressure means that the flow rate of the exhaust gas through the lines can be increased even for the same Reynolds number. Consequently, gas components in an excited state are able to reach the plasma device in a comparatively short period of time, thereby making it possible to prevent deactivation. Moreover, since exhaust gas is allowed to flow in the form of viscous flow, although collisions between excited gas molecules occur frequently, since energy transfer mainly occurs between the excited gas molecules, the excited state of the exhaust gas components is maintained. In addition, even in the case of maintaining an excited state in the plasma device, plasma is easily generated by gas components in the excited state formed with the production equipment, thereby making it possible to conserve on energy required for plasma generation.

The examiner indicated in the Office Action that Breithbarth et al. teach an exhaust gas treatment method in which the exhaust gas is reacted with a reaction remover in the form of a viscous flow – this is not so. Breithbarth et al. merely describe that "the plasma-chemical conversion according to invention of the fluorohalides compounds by plasma-chemical process, which can be endothermic, to interact with a solid surface can be accomplished in the low pressure range". Specifically, Breithbarth et al. fail to disclose that the exhaust gas is reacted with a reaction remover in the form of a viscous flow.

Consequently, the method of the claimed invention is different from the invention of Breithbarth et al. and prominent effects can be obtained by the claimed invention. Accordingly, the claimed invention is not obvious over Breithbarth et al.

With Respect to the Rejection of Claim 8

Apparatus claim 8 has been amended to further include the technical features of "at least a portion of the exhaust gas is already in an excited state when the exhaust gas is introduced into the excitation unit" and "the exhaust gas is made to flow in the form of a viscous flow during

flow of the exhaust gas under reduced pressure" as in amended claim 1. Accordingly, the prominent effects described above can also be obtained by the exhaust gas treatment apparatus of claim 8.

Furthermore, in the claimed exhaust gas treatment apparatus, the excitation unit and the reaction removal unit are structurally separable as shown in FIG. 1, whereas in the exhaust gas treatment apparatus of Breithbarth et al, the excitation unit and the reaction removal unit are structurally integrated, namely, a glass tube which is half-shelled with two electrodes acts as an excitation unit and also a reaction removal unit (FIG. 1).

In general, the amount of exhaust gas treated depends on the size of the reaction removal unit, and thus, the reaction removal unit is preferably a large size. Meanwhile, since the size of the excitation unit depends on the electric power energy required for excitation, the excitation unit is preferably a small size in terms of energy-saving.

In the present invention, the claimed exhaust gas treatment apparatus has a structure in which the excitation unit and the reaction removal unit are structurally separable. Therefore, the sizes of the excitation unit and reaction removal unit can be adjusted respectively according to needs, thereby enabling the claimed exhaust gas treatment apparatus to treat a larger amount of exhaust gas using less electric power.

Consequently, the claimed invention is different from the invention of Breithbarth et al. and prominent effects can be obtained by the claimed invention. Accordingly, the claimed invention is not obvious over Breithbarth et al.

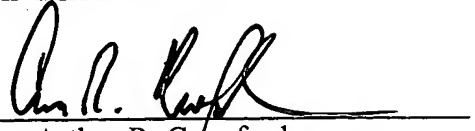
For the above reasons it is respectfully submitted that the claims of this application define inventive subject matter. Reconsideration and allowance are solicited.

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Respectfully submitted,

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